

**PARAKEELYA: A NEW GENUS SEGREGATED FROM CALANDRINIA
(PORTULACACEAE)**

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ABSTRACT

Extensive analyses of Portulacaceae have demonstrated that traditional circumscriptions of the genus *Calandrinia* Kunth were artificial, and that the included species were intertwined phylogenetically with many other Portulacaceae lineages. Roger Carolin proposed that the Australian endemic species of *Calandrinia* sensu lato, which are not related closely to *Calandrinia* sensu stricto, be transferred to *Rumicastrum* Ulbr., but combinations were never made. *Rumicastrum* appears to belong to Chenopodiaceae, however, as Ulbrich suggested. Here, the genus *Parakeelya*, based on an aboriginal name, is established to accommodate the Australian endemic calandrinias. New combinations are provided for 38 names.

KEY WORDS: Australia, *Calandrinia*, *Parakeelya*, Portulacaceae, phylogenetics, *Rumicastrum*

In seminal phylogenetic studies of Portulacaceae, Carolin (1987, 1993) determined that the traditional circumscription of the genus *Calandrinia* Kunth (100-150 spp.; e.g., Pax & Hoffmann 1934; cf. McNeill 1974; Nyanyano 1986) was unnatural, and that the species were intertwined phylogenetically with many lineages of Portulacaceae. Carolin's general conclusion was corroborated in subsequent investigations (Hershkovitz 1991a, 1991b, 1993a, 1993b; Hershkovitz & Zimmer 1997, submitted ms.). Hershkovitz (1993a, 1993b) showed that *Calandrinia* sensu stricto was a morphologically well-defined lineage comprising fourteen species native to the Americas, and that these species are not related closely to a group of 35-50 Australian native species classified in *Calandrinia* sensu lato (though one species of *Calandrinia* sensu stricto is adventive in Australia -- see below). These phylogenetic results have been corroborated by ribosomal DNA sequence data (Hershkovitz & Zimmer 1997; submitted ms.).

Carolin (1987, 1993) proposed that the Australian endemic calandrinias should be transferred to the genus *Rumicastrum* Ulbr., which had been described as a monotypic

genus of Chenopodiaceae from Western Australia (Ulbrich 1934). Presumably, Carolin believed that a specimen identified as *Rumicastrum chamaecladum* Ulbr., George 16288 (PERTH,B; Carolin 1987) actually was an unspecified Australian calandrinia, notwithstanding that the diagnosis and illustration of *Rumicastrum* (Ulbrich 1934) impart no hint of portulacaceous affinity. Carolin's proposal was reiterated in papers coauthored by Carolin (Syeda & Carolin 1989, 1990; Kühn *et al.*, 1993). Hershkovitz (1991a, 1991b, 1993a, 1993b) accepted on faith Carolin's proposal.

Nomenclatural realignments reflecting the compelling phylogenetic evidence were formalized for several members of *Calandrinia* sensu lato and other Portulacaceae (see Hershkovitz 1993a; Hershkovitz & Zimmer 1997), but the Australian calandrinias were not renamed, even in subsequent floristic treatments (see below). Several factors probably have contributed to the delay in renaming these plants, including inertia and perhaps the name *Rumicastrum* itself, which seems perfectly appropriate for a chenopod but unpalatable for attractive members of Portulacaceae. Also, Hershkovitz' work concentrated primarily on American plants such that formal names for Australian plants were dispensable.

Hershkovitz & Zimmer (1997) included an Australian calandrinia (*Calandrinia ptychosperma* F. Muell.) in their analysis of ribosomal DNA data for the portulacaceous alliance. In the original draft of their paper, they had recombined this species under *Rumicastrum*. Werner Greuter and Brigitte Zimmer (pers. comm., 13III1997) kindly advised the authors that "*Rumicastrum chamaecladum*, as evidenced by the specimen George 16288, which perfectly fits the original description (and would be a good neotype) has nothing, but absolutely NOTHING to do with Australian *Calandrinia*. We are persuaded it is a perfectly good chenopod reasonably close to *Atriplex*." The holotype of *Rumicastrum chamaecladum* presumably was destroyed during World War II. Hershkovitz & Zimmer (1997) thus reverted to using *Calandrinia* for their plant, as the circumscription of *Calandrinia* was not the focus of that paper.

In a manuscript currently in review, Hershkovitz & Zimmer present ribosomal DNA evidence reinforcing the morphologically-based circumscription of *Calandrinia* sensu stricto. The data again show that the sampled Australian taxon is not related closely to this genus. In the context of the submitted manuscript, the appellation of *Calandrinia* for the Australian plant is awkward and misleading, necessitating a new generic name.

The present paper proposes the generic name *Parakeelya* for the Australian calandrinias. This name derives from the vernacular name "parakeelya" applied generically to *Calandrinia polyandra* Benth. by Black (1948), to *Calandrinia* (presumably referring to the Australian species only) by West (1986), and, with specific epithets, to other species of Australian calandrinias by Black (1948) and numerous floristicicians (see below). "Parakeelya" apparently is an alternative spelling for "periculia," the aboriginal vernacular for the seed meal of *Calandrinia balonensis* Lindl. (Mueller 1876; cf. Poellnitz 1934).

The only purpose of the present paper is to validate names for the Australian species. A comprehensive generic description is problematic. The Australian calandrinias comprise a diverse assemblage. For some characters, the species

approach the full range of variation found in Portulacaceae as a whole (e.g., growth habit, seed geometry and sculpturing, pollen morphology; Carolin 1987, 1993; Syeda 1979; Syeda & Ashton 1989; Syeda & Carolin 1989, 1990; see also floristic references cited below). There appears to be no known single character that ties the species together. Some features that occur among these species are unique or unusual among Portulacaceae, e.g., capsules that split only at the apex, polyforate-operculate pollen, three-dimensional leaf venation, and anisocytic stomata (Carolin 1987, 1993; Hershkovitz 1991b). In fact, monophyly of the Australian species has not been demonstrated. Carolin's (1987) cladogram of Portulacaceae showed polyforate-operculate pollen as a synapomorphy of this group, but several species have pantocolpate pollen (Carolin 1987; Kelley 1973), which plausibly is primitive in this group (Carolin 1987; Hershkovitz 1993a). Polyphyly of the Australian species is not supported, either. Specifically, there are no features that link particular species to otherwise divergent lineages of Portulacaceae. To the contrary, and despite the lack of a clear synapomorphy, the species appear to be linked to one another by combinations of features.

Because of the variability in this group, as well as the poor representation of herbarium material of these taxa in the United States and Europe, the generic diagnosis will emphasize the traits of the one species for which ribosomal DNA evidence is available, *Calandrinia ptychosperma* F. Muell. The diagnosis basically will be that of Mueller (1876, elaborated from Mueller 1864), amended to include mention of polyforate-operculate pollen. The diagnosis obviously will omit reference to the range of variation in the species being transferred, but, at the same time, it will be much more applicable to the Australian species in general than is that of *Calandrinia*.

Calandrinia ptychosperma is designated here as the type for the generic name, even though the vernacular name "parakeelya" refers to either or both of *Calandrinia balonensis* and *C. polyandra*. *Calandrinia balonensis* and *C. polyandra* have 12-15-pantocolpate pollen (Carolin 1987; Kelley 1973), while *C. ptychosperma* has polyforate-operculate pollen. To the degree that polyphyly of the Australian plants is conceivable, these alternative pollen states represent one of the plausible distinctions. I have observed, however, that *C. balonensis* is among the Australian species that have three-dimensional leaf venation (Hershkovitz 1991b), so I suspect that additional research will show that the Australian plants indeed are monophyletic.

Specific combinations will be provided for those species that otherwise are validly published and accepted in the most recent Australian floristic and taxonomic works (Beard 1970; Blackall & Grieve 1988; Chapman 1991; Cunningham *et al.* 1992; Green 1985; Queensland Herbarium 1993; Syeda 1979, 1981, 1996; Walsh 1996; West 1986, 1987, 1990, 1992). Chapman (1991) listed 60 specific and subspecific combinations in *Calandrinia* in Australia, of which 53 pertain to *Parakeelya*. One name pertains to *Anacampseros* (Hershkovitz 1993), and six have been applied in reference to the American native *C. ciliata* (Ruiz & Pavón) DC., which has established adventively in Australia. [All current Australian floras use *C. menziesii* (Hook.) Torrey & A. Gray for this species. Discordance with current opinion in American works (e.g., Kelley 1993) aside, documentation of the identity of the Australian plants with, specifically, the type of *C. menziesii* appears to be lacking.] For the group here circumscribed as *Parakeelya*, Syeda & Carolin (1990) indicated that there are 34 species, while Carolin (1993) indicated that there are 50. Review of the floristic work suggests that 33 validly published species are accepted. These plus one problematic

name are transferred here to *Parakeelya*. Two additional species described by Syeda (1979) remain unpublished (Syeda & Carolin 1988), and another two apparently are unidentified/undescribed (West 1990; Queensland Herbarium 1993). Additional names listed by Chapman (1991) that pertain to *Parakeelya* are disposed in the discussion following the taxonomic treatment below.

PARAKEELYA Hershkovitz, gen. nov. TYPE: *Parakeelya ptychosperma* (F. Muell.) Hershkovitz (*Calandrinia ptychosperma* F. Muell.).

Herba humilis, glabra, foliis radicalibus linearifiliformibus confertis acutis, caulinis brevioribus, racemis paucifloris, bracteis acutis scariosis, pedicellis calyce ter aliquotiesve rarius vix longioribus aetate erectiusculis, sepalis persistentibus rotundo-ovatis acutatis, pollinis grana polyporus-operculatus, stylo nullo, capsula calycem breviter superante vel aequante apice quadrivalvi cylindrico-conica, seminibus nitentibus fusco-atris simpliciter longitudinali-sulcatis fere reniformibus.

PARAKEELYA ARENICOLA (Syeda) Hershkovitz, comb. nov. BASIONYM: *Calandrinia arenicola* Syeda, Proc. Linn. Soc. New South Wales 116:153. 1996.

PARAKEELYA BALONENSIS (Lindl.) Hershkovitz, comb. nov. BASIONYM: *Calandrinia balonensis* Lindl. in T.L. Mitchell, J. Exped. Trop. Australia. 148. 1848.

PARAKEELYA BREVIPEDATA (F. Muell.) Hershkovitz, comb. nov. BASIONYM: *Calandrinia brevipedata* F. Muell., Fragm. 10:69. 1876.

PARAKEELYA CALYPTRATA (Hook. f.) Hershkovitz, comb. nov. BASIONYM: *Calandrinia calyprata* Hook. f. in Hook., Icon. Pl. 3:296. 1840.

PARAKEELYA COMPOSITA (Nees) Hershkovitz, comb. nov. BASIONYM: *Calandrinia polypetala* Fenzl in Endl. et al. var. *composita* Nees in Lehm., Pl. Preiss. 1:247. 1845.

PARAKEELYA CORRIGIOLOIDES (F. Muell. ex Benth.) Hershkovitz, comb. nov. BASIONYM: *Calandrinia corriglioides* F. Muell. ex Benth., Fl. Austral. 1:175. 1863.

PARAKEELYA CREETHAE (Tratman ex Morrison) Hershkovitz, comb. nov. BASIONYM: *Calandrinia creethae* Tratman ex Morrison, J. Bot. 50:165. 1912.

PARAKEELYA DISPERMA (J.M. Black) Hershkovitz, comb. nov. BASIONYM: *Calandrinia disperma* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 45:11, t. III. 1921.

PARAKEELYA EREMAEA (Ewart) Hershkovitz, comb. nov. BASIONYM: *Calandrinia eremaea* Ewart, Fl. Victoria 486. 1921. SYNONYM: *Calandrinia pusilla* Lindl., nom. illegit., in T.L. Mitchell, J. Exped. Trop. Australia. 360. 1848, non *Calandrinia pusilla* Barnéoud 1846.

PARAKEELYA GRACILIS (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia gracilis* Benth., *Fl. Austral.* 1:173. 1863.

PARAKEELYA GRANULIFERA (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia granulifera* Benth., *Fl. Austral.* 1:176. 1863.

All current floristic references (see above) regard *Talinum nanum* Nees 1845 as a taxonomic synonym of *Calandrinia granulifera* Benth. Nee's epithet has priority, but it was not available for recombination in *Calandrinia* (see discussion below). *Parakeelya granulifera* becomes the valid name for *Calandrinia granulifera* if it is considered distinct from *Talinum nanum*.

PARAKEELYA LEHMANNII (Endl.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia lehmannii* Endl. in Lehm., *Pl. Preiss.* 2:235. 1848.

PARAKEELYA LINIFLORA (Fenzl) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia liniflora* Fenzl in Endl. et al., *Enum. Pl.* 52. 1837.

PARAKEELYA NANA (Nees) Hershkovitz, *comb. nov.* BASIONYM: *Talinum nanum* Nees in Lehm., *Pl. Preiss.* 1:246. 1845. SYNONYMS: *Calandrinia pygmaea* F. Muell. *nom. illegit.*, *Fragn.* 1:175. 1859; *Calandrinia neesiana* H. Eichler, *Taxon* 12:295. 1963.

Calandrinia pygmaea F. Muell. was illegitimate because it was a homotypic synonym of *Talinum nanum* Nees. Nonetheless, *Calandrinia pygmaea* was adopted in taxonomic and floristic works until the middle of the 20th century (e.g., Bentham 1863; Poellnitz 1934; Black 1948), by which time the proper recombination of *Talinum nanum* had been preempted by *Calandrinia nana* Philippi 1894. [Beard (1970) included the name "Calandrinia nana (Nees) C.A. Gardn." in his checklist, without a reference or basionym.] *Calandrinia neesiana* H. Eichler became the new name for *Talinum nanum*, but this now is widely regarded as a taxonomic synonym of *Calandrinia granulifera* Benth. *Parakeelya nana* has priority over *Calandrinia granulifera* when these are regarded as the same species.

PARAKEELYA PAPILLATA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia papillata* Syeda, *Telopea* 2:60. 1980.

PARAKEELYA PICKERINGII (A. Gray) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia pickeringii* A. Gray, *U.S. Expl. Exped.*, Phan. 1:144. 1854.

PARAKEELYA PLEIOPETALA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia pleiopetala* F. Muell., *Fragn.* 10:70. 1876.

PARAKEELYA POLYANDRA (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia polyandra* Benth., *Fl. Austral.* 1:172. 1863. SYNONYM: *Talinum polyandrum* Hook. *nom. illegit.*, *Bot. Mag.* 4833. 1855, non *Talinum polyandrum* Ruiz & Pavón, *Syst. Veg. Fl. Peruv. Chil.* 115. 1798.

PARAKEELYA POLYPETALA (Fenzl) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia polypetala* Fenzl in Endl. et al., *Enum. Pl.* 51. 1837.

PARAKEELYA PORIFERA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia porifera* Syeda, Telopea 2:59. 1980.

PARAKEELYA PRIMULIFLORA (Diels) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia primuliflora* Diels in Diels & E. Pritz., Bot. Jahrb. Syst. 35:198, fig. 24 A-F. 1904.

PARAKEELYA PTYCHOSPERMA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia ptychosperma* F. Muell., Fragm. 4:137. 1864.

PARAKEELYA PUMILA (Benth.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia calyprata* Hook. f. in Hook. var. *pumila* Benth., Fl. Austral. 1:175. 1863.

PARAKEELYA QUADRIVALVIS (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia quadrivalvis* F. Muell., Fragm. 1:176. 1859.

PARAKEELYA REMOTA (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia remota* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 47:369. 1923.

PARAKEELYA RETICULATA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia reticulata* Syeda, Telopea 2:60. 1980.

PARAKEELYA SCHISTORHIZA (Morrison) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia schistorhiza* Morrison, J. Bot. 50:164. 1912.

PARAKEELYA SPERGULARINA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia spergularina* F. Muell., Fragm. 1:175. 1859.

PARAKEELYA SPHAEROPHYLLA (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia sphaerophylla* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 51:378. 1927.

PARAKEELYA STAGNENSIS (J.M. Black) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia stagnensis* J.M. Black, Trans. & Proc. Roy. Soc. South Australia 51:379. 1927.

PARAKEELYA STENOGYNA (Domin) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia stenogyna* Domin, Biblioth. Bot. 22(89):971. 1926

PARAKEELYA STROPHIOLATA (F. Muell.) Hershkovitz, *comb. nov.* BASIONYM: *Claytonia strophiolata* F. Muell., Fragm. 11:82. 1880. SYNONYM: *Calandrinia strophiolata* (F. Muell.) Poelln., Feddes Repert. Spec. Nov. Regni Veg. 35:173. 1934.

PARAKEELYA TUMIDA (Syeda) Hershkovitz, *comb. nov.* BASIONYM: *Calandrinia tumida* Syeda, Proc. Linn. Soc. New South Wales 116:156. 1996.

PARAKEELYA UNIFLORA (F. Muell.) Hershkovitz, comb. nov. BASIONYM:
Calandrinia uniflora F. Muell., Trans. & Proc. Philos. Inst. Victoria 3:41. 1857.

PARAKEELYA VOLUBILIS (Benth.) Hershkovitz, comb. nov. BASIONYM:
Calandrinia volubilis Benth., Fl. Austral. 1:174. 1863.

Based on the cited taxonomic and floristic references, additional names (excluding autonyms) in *Calandrinia* listed by Chapman (1991) are disposed taxonomically as follows:

- Calandrinia calyprata* Hook. f. in Hook. var. *pumila* Benth, homotypic synonym of *Parakeelya pumila*.
Calandrinia caulescens Kunth, synonym of *Calandrinia ciliata*.
Calandrinia caulescens Kunth var. *menziesii* (Hook.) A. Gray, synonym of *Calandrinia ciliata*.
Calandrinia ciliata (Ruiz & Pavón) DC., accepted.
Calandrinia compressa Schrad. ex DC., accepted, probably does not occur in Australia (Poellnitz 1934).
Calandrinia cygnorum Diels, synonym of *Parakeelya brevipedata*.
Calandrinia dipetala J.M. Black, synonym of *Parakeelya calyprata*.
Calandrinia liniflora Fenzl in Endl. et al. var. *grandiflora* Benth., synonym of *Parakeelya liniflora*.
Calandrinia maryonii S. Moore, synonym of *Parakeelya ptychosperma*.
Calandrinia menziesii (Hook.) Torrey & A. Gray, synonym of *Calandrinia ciliata*.
Calandrinia morrisae Goy, synonym of *Parakeelya ptychosperma*.
Calandrinia pogonophora F. Muell., synonym of *Anacampseros australiana* J.M. Black.
Calandrinia polyandra Benth. var. *leptophylla* Benth., status uncertain (West 1986; cf. Black 1948).
Calandrinia polypetala Fenzl in Endl. et al. var. *composita* Nees, homotypic synonym of *Parakeelya composita*.
Calandrinia tepperiana W. Fitzg., synonym of *Parakeelya quadrivalvis*.
Calandrinia volubilis Benth. var. *parvula* J.M. Black, status uncertain, not mentioned in cited floras (including Black 1948).

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